REMARKS

A Request for Continued Examination has been submitted concurrently herewith. Accordingly, Applicants requests that the foregoing amendment be entered and that this application be examined in view of the remarks set forth below.

Claims 1-6 and 9 have been rejected under 35 USC §102(b) as anticipated by Kusase et al (U.S. Patent No. 5,483,116), while Claims 7 and 8 have been rejected under 35 USC §103(a) as unpatentable over Kusase et al in view of Ragaly (JP 11-285214). However, for the reasons set forth hereinafter, Applicants respectfully submit that independent Claims 1 and 7 of the present application, and accordingly all claims of record, distinguish over the cited references, whether considered separately or in combination.

The present invention is directed to a vehicular alternator that includes permanent magnets for auxiliary excitation. More specifically, the alternator according to the invention has a rotor which is constructed with a pair of opposing "claw-type" magnetic poles that are nested together in a manner such that the respective claws of the two poles are interdigitated, and separated by gaps, as best shown in Figure 7 of the application. The permanent magnets are inserted between opposing surfaces of the respective interdigitated claws.

In conventional vehicular alternators of the type described above, including the Kusase et al and Ragaly references, the claws of the respective magnetic holes are tapered along their axial extent, so that each claw is thinner (in the radial direction) at its tips than at its base. Thus, the claws have a substantially triangular shape in a longitudinally and radially extending section plane, as seen, for example, in Figures 1 and 6 of Kusase et al (elements 15 and 16) and in Figure 7 of Ragaly (elements 10).

A heretofore unresolved problem in alternators of the type described, is that due to the lack of complete contact between the claws on the one hand, and the entirety of the opposing magnetic pole surfaces of the magnets on the other hand, resistance to a flow of magnetic flux in the magnetic circuit formed by the permanent magnet is increased (and the magnetic losses as well). That is, as is the case in both Kusase et al and Ragaly, due to the tapered (triangular) shape of the claws, and the rectangular shape of the permanent magnet pole surfaces, a portion of the magnetic pole surface does not make contact with the claw. This can be seen, for example, in Figure 1 of Kusase et al, in which the lower right hand portion of the magnet 11 does not make contact with the claw type pole 16. The same is also true in Ragaly, as shown in Figure 7.

The present invention addresses and resolves this problem by providing each of the claw type magnetic poles with a shape such that its surface which faces and abuts the magnetic pole surface of the adjacent permanent magnet makes contact with the entirety of such pole surface. Various embodiments

accomplish this structure in differing ways. For example, in the embodiment illustrated in Figures 2 and 3, auxiliary magnetic pole portions 21 are provided at the lateral edges of each of the claws 5Aa and 5Ba. The latter extend downwardly and, despite the tapering of the circumferentially central part of the claws, form a face that corresponds to the shape of the magnetic pole surfaces of the pole magnets, so that the claw itself makes contact with the entirety of the magnetic pole surface of the permanent magnet.

In another embodiment, illustrated in Figure 6, the claws are not tapered in the axially direction, but rather have a uniform thickness in the axial direction, so that the lateral faces of the claws make contact with the entirety of the magnetic pole surfaces of the permanent magnet.

Under the heading "Response to Arguments", the final Office Action states that the arguments advanced by the Applicants in the amendment filed July 17, 2002 are predicated on features which are not recited in the rejected claims (Office Action at page 4). In response to this observation, Applicants note that the final paragraph of Claim 1, according to the previous amendment, recites in particular that

> "each of said plurality of claws of said rotor has a shape such that opposing surfaces of adjacent claws are in contact with the whole of the magnetic pole surfaces of said permanent magnets."

For the reasons set forth below, Applicants respectfully submit that this feature of Claim 1 (which is substantially repeated in Claim 7) is neither taught nor suggested by either of Kusase et al or Ragaly et al.

Nevertheless, in order to further clarify this point, Applicants have revised the language of Claims 1 and 7 to recite in particular that the permanent magnets have "rectangular lateral surfaces which form the magnetic pole surfaces disposed between and in contact with opposing surfaces of the adjacent claws", and that the opposing surfaces of the adjacent claws "are formed into substantially the same shape as the magnetic pole surfaces with which they are in contact", such that the claws "are in contact with the whole of the magnetic pole surfaces of said permanent magnets."

At page 2, the Office Action states that Figure 3 in Kusase et al shows that the auxiliary magnetic pole portion is in contact with the whole of the magnetic pole surface of the permanent magnet. However, Applicants note that Figure 3 in Kusase et al is a cross-section taken at an unspecified plane in Figure 1, and therefore shows nothing concerning the shape of the claws 15 and 16 in a plane perpendicular to the plane of the drawing. Moreover, as clearly shown in Figure 1, both of the claws 15 and 16 are in fact tapered in the axial direction, so that there thickness in the radial direction clearly varies. Thus, the cross-sectional area of the claws 15 and 16 in Figure 3 will depend upon the axial location of the

section plane. Thus, as can be seen by reference to Figure 1, if the section plane is moved axially to the right, the cross sectional thickness of the claw 16 in Figure 3 will decrease, and the cross-sectional thickness of the claw 16 will increase. On the other hand, if the sectional plane is moved to the left side in Figure 1, the claw 15 will increase in cross-sectional area, while the claw 16 decreases in cross-sectional area. Such a cross section is indicated in the attached Figure "Z", which shows Figure 3 of Kusase et al, redrawn to reflect the shifting of the section plane to the right. In fact, it is apparent that the cross section, as shown in Figure 3 will occur only if the section plane is taken at the middle of Figure 1 in the axial direction.

Based on the foregoing, Applicants respectfully submit that there is a portion of the magnet 11 in Kusase et al which does not contact with the surface of the adjacent claw. That is, a portion of each of the magnetic pole surfaces is exposed. Accordingly, in Kusase et al, the opposing surfaces of the claws adjacent the permanent magnets are not "in contact with the whole of the magnetic pole surfaces of said permanent magnets" as recited in Claims 1 and 7. Furthermore, the permanent magnets in Kusase et al, which as noted previously are tapered, do not have a "rectangular lateral surfaces which...form magnetic pole surfaces disposed between and in contact with opposing surfaces of adjacent claws" as also recited in Claims 1 and 7.

The same deficiencies as described above, also apply with respect to Ragaly. That is, like Figure 3 of Kusase et al, Figure 16 of Ragaly is a cross

section, which as a definitional matter shows nothing concerning the shape of the elements M2 and M3 in a plane perpendicular to the plane of the drawing, or concerning the cross-sectional area of M2 and M3 in a plane parallel to that of the drawing in Figure 16 but translated to a different location along the axial direction. In fact, as is clearly shown in Figure 7 of Ragaly, the claws 10 are tapered in the axial direction, as are those in Kusase et al and the present invention. Accordingly, the vertical extent of the interface designated (HH) by the Examiner in Figure 16, will depend on the axial location of the cross-sectional plane. Thus, the Ragaly reference also fails to teach or suggest the limitations referred to previously with regard to Kusase et al, and the magnetic flux leaks from the exposed portion of the permanent magnets, and the output of the alternator is diminished relative to that of the present invention.

In addition to the Figure "Z" previously referred to, also attached hereto are diagrams as follows:

Figure A corresponds to Figure 1 of the present invention;

Figure B corresponds to Figure 2 of the present invention;

Figure C corresponds to Figure 3 of the present invention(being a section taken along lines CC in Figure B);

Figure D is a sectional view taken along line DD in Figure B;

Figure W corresponds to Figure 1 of Kusase et al, and corresponds to Figure A of the present invention;

Figure X is a cut out portion of Figure W, which shows only the claw 16 in Figure W;

Figure Y is a copy of Figure 3 of Kusase et al, which corresponds to a sectional view taken along line YY in Figure X;

Figure Z is a sectional view taken along lines ZZ in Figure X; and

Figure O is a copy of Figure 7 of Ragaly et al.

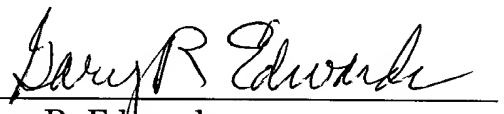
In light of the foregoing remarks, this application should be in condition for allowance, and early passage of this case to issue is respectfully requested.

If there are any questions regarding this amendment or the application in general, a telephone call to the undersigned would be appreciated since this should expedite the prosecution of the application for all concerned.

It is respectfully requested that, if necessary to effect a timely response, this paper be considered as a Petition for an Extension of Time sufficient to effect

a timely response and shortages in other fees, be charged, or any overpayment in fees be credited, to the Deposit Account of Crowell & Moring, LLP, Account No. 05-1323 (Docket #381KA/50358).

Respectfully submitted,



Gary R. Edwards
Registration No. 31,824

CROWELL & MORING, LLP
Intellectual Property Group
P.O. Box 14300
Washington, DC 20044-4300
Telephone No.: (202) 624-2500
Facsimile No.: (202) 628-8844
GRE:kms 56205

VERSION WITH MARKINGS TO SHOW CHANGES MADE TO THE CLAIMS

Please amend the claims as follows:

1. (Twice Amended) A vehicular alternator comprising a rotor and a stator constituted by coiling stator windings over a stator core, wherein:

said rotor comprises a pair of claw-type magnetic poles arranged in an opposed relation, permanent magnets having rectangular lateral surfaces, which face in a circumferential direction of the rotor and form magnetic pole surfaces, disposed between and in contact with opposing surfaces of adjacent claws of said pair of claw-type magnetic poles, and field windings coiled radially inward of said plurality of claws; and

the opposing surfaces [each] of said [plurality of] claws [of said rotor has a shape] adjacent said permanent magnets are formed into substantially the same shape as the magnetic pole surfaces with which they are in contact, such that said [opposing surfaces of adjacent] claws are in contact with the whole of the magnetic pole surfaces of said permanent magnets.

7. (Twice Amended) A vehicular alternator comprising a rotor and a stator constituted by coiling stator windings over a stator core, wherein:

said rotor comprises a pair of claw-type magnetic poles arranged in an opposed relation, permanent magnets having rectangular lateral surfaces,

which face in a circumferential direction of the rotor and form magnetic pole surfaces, disposed between and facing opposing surfaces of adjacent claws of said pair of claw-type magnetic poles, and field windings coiled radially inward of said plurality of claws;

said claws are tapered toward their tips, such that they have a substantially triangular shape in a section along an axial direction of the rotor;

an auxiliary magnetic pole plate is interposed between each of said plurality of claws and said permanent magnet; and

each [said] auxiliary magnetic pole plate [has a shape such that it makes] has substantially the same shape as a corresponding adjacent magnetic pole surface of said permanent magnet, so that said auxiliary magnetic pole plate is in contact with the whole of the magnetic pole surfaces of said permanent magnet.